DOE/EH-0545

SEISMIC EVALUATION PROCEDURE

FOR EQUIPMENT IN U.S. DEPARTMENT OF ENERGY FACILITIES

March 1997

U. S. DEPARTMENT OF ENERGY

Office of Defense Programs
Office of Environment, Safety and Health

EXECUTIVE SUMMARY

At U.S. Department of Energy (DOE) facilities, safety analyses and facility-specific action may require the evaluation of systems and components subjected to seismic hazards. DOE has a program that provides guidance for evaluating DOE equipment and distribution systems using experience data from past seismic events and shake table tests. The program relies on the use of facility walkdowns as a means of efficiently identifying and fixing deficiencies of systems and components. Screening criteria is applied with the walkdowns such that items that pass the criteria are accepted without detailed analysis or testing. This report provides the implementation procedure for the program.

A primary objective of the DOE Seismic Evaluation Procedure is to provide comprehensive guidance for consistent seismic evaluations of equipment and distribution systems in DOE facilities. Due to the evolution of design and operating requirements, developments in engineering technology, and differing hazards and missions, DOE facilities embody a broad spectrum of design features for earthquake resistance. The earliest-vintage facilities often have the least seismic design considerations and potentially exhibit the greatest difference between their design basis and what DOE requires today for seismic design criteria for new facilities. The approach sometimes used to review the seismic capacity of equipment and distribution systems includes sophisticated evaluations or qualification testing that can be very time consuming, complex, and costly. This Procedure is designed to be a cost-effective method of enhancing the seismic safety of facilities by emphasizing the use of facility walkdowns and engineering judgment based on seismic experience data.

The DOE Seismic Evaluation Procedure is adapted from Part II of Revision 2 of the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) (Ref. 1) used by the nuclear power industry. The SQUG GIP provided a procedure for resolving a U.S. Nuclear Regulatory Commission (NRC) unresolved safety issue through the use of experience and generic test data of equipment in industrial facilities subjected to strong motion seismic events. With a Safety Evaluation Report (Ref. 2), the NRC approved the program implemented by the SQUG GIP.

The DOE Seismic Evaluation Procedure builds on the procedures and screening criteria in the SQUG GIP by incorporating DOE-specific requirements and guidance and broadening the application of the experience-based methodology to equipment classes not contained in the SQUG GIP. The DOE Procedure has information from DOE Orders and Standards, DOE state-of-the-practice manuals for seismic upgrades of equipment, the Seismic Evaluation Procedure (SEP-6) used at the Savannah River Site (Ref. 3), and other documents from DOE sites that discuss experience-based methodologies and guidelines. The scope of equipment covered in the DOE Procedure includes classes of equipment from the SQUG GIP, such as batteries on racks, motor control centers, switchgear, valves, pumps, motor generators, tanks, cable and conduit raceway systems, and relays. In addition, the DOE Procedure includes guidelines for evaluating the seismic adequacy of piping systems, HVAC ducts, glove boxes, unreinforced masonry (URM) walls, and other classes of equipment in DOE facilities. The provisions of the DOE Procedure have been subjected to independent technical reviews as discussed in Section 1.4.2 and a letter that provides a summary of the reviews is attached at the end of the Foreword.

This report is divided into five parts in order to identify the relationships of the DOE procedure with the SQUG GIP. Part I is titled the General Approach for DOE Seismic Evaluation Procedure and contains the first four chapters. Part II is titled the Seismic Evaluation Procedures Modified from the SQUG GIP and is based on corresponding sections in the SQUG GIP. Part III, which contains Chapters 8 and 9, is titled the Seismic Evaluation Procedures Adopted Directly from the SQUG GIP and is nearly identical to corresponding sections in the SQUG GIP. Part IV is titled the Seismic Evaluation Procedures Developed Uniquely for the DOE and contains Chapter 10. Finally, Part V is titled Additional Seismic Evaluation Procedures Modified from the SQUG GIP and is based on corresponding sections in the SQUG GIP.